Pre-Inspection Checklist for High Pressure Boilers

Spring 2003

Notice: This checklist reflects the most common violations our field inspectors encounter when performing an inspection on a high-pressure steam boiler installation. It's suggested that boiler industry personnel have access to a current set of applicable codebooks/jurisdictional laws. Such as: **Section I of the ASME Boiler Code: B31.1 ASME Code for Pressure Piping: the National Board Inspection Code (NBIC), Chapter 296-104 WAC, and Chapter 70.79 RCW of the Washington State Boiler and Unfired Pressure Vessel Laws.**

Administration and General Requirements

- Every contractor shall be registered with the Department of Labor and Industries before installing/reinstalling, making repairs, or modifications to any boiler. See RCW 18.27 and 18.106
- Every contractor shall apply for and obtain a permit from the boiler section prior to making the installation/reinstallation of any boiler. See WAC 296-104-020
- A minimum clear space of eighteen inches (18") shall be provided on all sides of the boiler. As a minimum, all other sides shall comply with the boiler manufacturer's installation instructions for clearances to combustible materials. See WAC 296-104-255, 260, 265 and 271
- The owner or user of any boiler required to be inspected upon installation/reinstallation shall not operate the boiler until a certificate-inspection has been made. See RCW 70.79.320
- All high-pressure boilers shall be constructed, stamped, and installed in accordance with Section I and B31.1 of the ASME code. See WAC 296-104-200
- All high-pressure boiler fuel trains shall comply with the requirements of ASME CSD-1 (Part CF). See WAC 296-104-200

Instruments, Fittings, and Controls

- Boilers with an MAWP of 400 psi or less require at least one gage glass. See Section I PG-60
- Boilers with an MAWP over 400 psi require at least two gage glasses. See Section I PG-60

- The lowest visible part of the water gage glass shall be at least 2 in. above the lowest permissible water level, as determined by the boiler manufacturer. See Section I PG-60
- Tubular or transparent gages that rely on observing the steam-water interface and consist of multiple sections shall have a minimum of 1 in. overlap of the visible portions. See Section I PG-60
- Boilers of the horizontal fire tube type shall be set that when the water is at the lowest reading in the water gage glass there shall be at least 3 in. of water over the highest point of the tubes, flues, or crown sheet. See Section I PG-60
- All connections on the gage glass shall be not less than NPS ½. See Section I PG-60
- Each water gage glass shall be fitted with a drain cock or valve having an unrestricted drain opening of not less than ¼ in. diameter to facilitate cleaning. See Section I PG-60
- When the boiler operating pressure exceeds 100 psi the glass shall be furnished with a connection to install a valve drain to a safe discharge point. See Section I PG-60
- Each water gage glass shall be equipped with a top and bottom shutoff valve of such through-flow construction as to prevent stoppage by deposits of sediments. See Section I PG-60
- Straight-run globe valves shall not be used on such connections. See Section I PG-60
- The pressure–temperature rating of such valves shall be at least equal to that of the lowest set pressure of any safety valve on the boiler drum and the corresponding saturated-steam temperature. See Section I PG-60
- The water column shall be so mounted that it will maintain its correct position relative to the normal waterline under operating conditions. See Section I PG-60
- The water column shall be fitted with a connection for a drain cock or drain valve to install a pipe of at least NPS ¾ to a safe point of discharge. See Section I PG-60
- Connections from the boiler to the water column shall be at least NPS 1. Connections for gage glasses connected directly to the boiler shall be at least NPS ½. Connections from the boiler to the remote level indicator shall be at least NPS ¾ to and including the isolation valve and from there to the remote level indicator at least ½ in. O.D. tubing. These connections shall be completely independent of other connections for any function other than water level indication. See Section I PG-60

- For pressures of 400 psi or over, lower connections to drums for water columns and remote level indicators shall be provided with shield, sleeves, or other suitable means to reduce the effect of temperature differentials in the shells or heads. See Section I PG-60

- The steam and water connections to a water column or a water gage glass shall be such that they are readily accessible for internal inspection and cleaning. See Section I PG-60
- Shutoff valves shall not be used in the pipe connections between a boiler and a water column or between a boiler and the shutoff valves required for the gage glass, unless they are either outside-screw-and-yoke or lever-lifting type gate valves or stopcocks with lever permanently fastened thereto and marked in line with their passage. See Section I PG-60
- Gage cocks are not required. See Section I PG-60
- Each boiler shall have a pressure gage so located that it is easily readable. The pressure gage shall be installed so that it shall at all times indicate the pressure in the boiler. See Section I PG-60
- A valve or cock shall be placed in the gage connection adjacent to the gage. See Section I PG-60
- For a steam boiler the gage or connection shall contain a siphon or equivalent device, which will develop and maintain a water seal that will prevent steam from entering the gage tube. See Section I PG-60
- Pressure gage connections to the boiler, except the siphon, if used, shall not be less than NPS ¼ but where steel or wrought iron pipe or tubing is used, they shall not be less than ½ inch inside diameter. See Section I PG-60
- The dial of the pressure gage shall be graduated to approximately double the pressure at which the safety valve is set, but in no case to less than 1 ½ times this pressure. See Section I PG-60
- Each boiler shall be provided with a valve connection at least NPS ¼ for the exclusive purpose of attaching a test gage when the boiler is in service, so that the accuracy of the boiler pressure gage can be ascertained. See Section I PG-60
- Each high-temperature water boiler shall have a temperature gage so located and connected that it shall be easily readable. The temperature gage shall be installed so that it at all times indicates the temperature in degrees Fahrenheit of the water in the boiler, at or near the outlet connection. See Section I PG-60

Installation Requirements

- Boilers having more than 500 sq. ft of water-heating surface shall have at least two means of feeding water. Each source of feeding shall be capable of supplying water to the boiler at a pressure of 3% higher than the highest setting of any safety valve on the boiler. See Section I PG-61
- For boilers having a water-heating surface of not more than 100 sq. ft the feed connection to the boiler shall not be smaller than NPS ½. See Section I PG-61
- For boilers having water heating surface more than 100 sq. ft the feed connection to the boiler shall not be less than NPS ¾. See Section I PG-61

- For boilers that are fired with solid fuel not in suspension, and for boilers whose setting or heat source can continue to supply sufficient heat to cause damage to the boiler if the feed supply is interrupted, one such means of feeding shall not be susceptible to the same interruption as the other, and each shall provide sufficient water to prevent damage to the boiler. See Section I PG-61
- Each boiler shall have at least one safety valve or safety relief valve and if it has more than 500 sq. ft of bare tube water heating surface, or if an electric boiler has a power input more than 1100 kW, it shall have two or more safety valves or safety relief valves. See Section I PG-67
- The safety valve or safety relief valve or valves shall be connected to the boiler independent of any other connection, and attached as close as possible to the boiler or the normal steam flow path, without any unnecessary intervening pipe or fitting. See Section I PG-71
- Every safety valve or safety relief valve shall be connected so as to stand in an upright position, with spindle vertical. See Section I PG-71
- The opening or connection between the boiler and the safety valve or safety relief valve shall have at least the area of the valve inlet. See Section I PG-71
- No valve of any description shall be placed between the required safety valve or safety relief valve or valves and the boiler, or on the discharge pipe between the safety valve or safety relief valve and the atmosphere. See Section I PG-71
- When a discharge pipe is used, the cross sectional area shall be not less than the full area of the valve outlet or of the total of the areas of the valve outlets, discharging there into. See Section I PG-71
- The discharge pipe shall be as short and straight as possible and so arranged as to avoid undue stresses on the valve or valves. See Section I PG-71
- Blow off and blow down pipe shall be steel. Galvanized steel pipe and fittings shall not be used. When the internal design pressure does not exceed 100psig the fittings shall be bronze, cast iron, malleable iron, ductile iron, or steel. When the internal design pressure exceeds 100psig the fittings shall be steel and the thickness of pipe and fittings shall not be less than that of Schedule 80 pipe. See B31.1-122.1.4
- The size of blow off and blow down piping shall be not less than the size of the connection on the boiler. See B31.1-122.1.4
- The minimum pressure and temperature rating for all valves and fittings in steam, feed water, blow off, and miscellaneous piping shall be equal to the pressure and temperature specified for the connected piping on the side that has the higher pressure, except in no case shall the pressure be less than 100psig and for pressures not exceeding 100psig in feed water and blow off service, the valves and fittings shall be equal at least to the requirements of the ASME for Class 125 cast iron or Class 150 steel. See B31.1-122.1.7

- Each boiler discharge outlet, except safety valve or safety relief valve connections, or reheater inlet and outlet connections, shall be fitted with a stop valve located at an accessible point in the steam-delivery line and as near to the boiler nozzle as is convenient and practicable. See B31.1-122.1.7
- When boilers are connected to a common header, the connection from each boiler having a manhole opening shall be fitted with two stop valves having an ample free-blow drain between them. See B31.1-122.1.7
- When a second stop valve is required, it shall have a pressure rating at least equal to that required for the expected steam pressure and temperature at the valve, or a pressure rating at least equal to 85 % of the lowest set pressure of any safety valve on the boiler drum at the expected temperature of the steam at the valve, whichever is greater. See B31.1-122.1.7
- All valves and fittings on steam lines shall have a pressure rating of at least 100psig. See B31.1-122.1.7
- The feed water piping shall be provided with a check valve and a stop valve or cock between the check valve and the boiler. See B31.1-122.1.7
- When two or more boilers are fed from a common source, there shall also be a globe or regulating valve in the branch to each boiler located between the check valve and the source of supply. Wherever globe style valves are used on feed piping, the inlet shall be under the disk of the valve. See B31.1-122.1.7
- Ordinary globe valves and other types of valves that have dams or pockets where sediment can collect shall not be used on blow off connections. See B31.1-122.1.7
- The blow off valve or valves, the pipe between them, and the boiler connection shall be of the same size. See B31.1-122.1.7
- For boilers with an allowable working pressure in excess of 100psig, each bottom blow off pipe shall have two slow-opening valves, or one quick-opening valve or cock, at the boiler nozzle followed by a slow-opening valve. See B31.1-122.1.7
- When the internal design pressure does not exceed 250psig, blow off valves or cocks shall be bronze, cast iron, ductile iron, or steel. The valves or cocks, if of cast iron, shall not exceed NPS 2 ½ and shall meet the requirements of the applicable ASME Standard for Class 250. See B31.1-122.1.7
- When the internal design pressure is higher than 250psig the blow off valves or cocks shall be of steel construction equal at least to the requirements of Class 300 of the applicable ASME Standard. The minimum pressure rating shall be equal to the value of the internal design pressure. See B31.1-122.1.7
- Boiler external piping may be installed by welding by a manufacturer or contractor other than the Manufacturer of the boiler provided such organization has been issued a Certificate of Authorization to use the "S," "PP," or "A" symbol stamp. The organizations, which fabricate or install

such piping, shall furnish proper code certification for it including a Manufacturers' Data Report Form P-4A. See Section I PG-109

- Mechanically assembled boiler external piping which contains no pressure boundary welds may be assembled by a non-stamp holder. Note that the responsibility for documentation and hydrostatic testing of a mechanically assembled boiler external piping must be assumed by a holder of a valid "S," "A," or "PP" stamp. Form P-4B, Manufacturers' Data Report for Field Installed Mechanically Assembled Piping, shall be used to record all field installed mechanically assembled boiler external piping. Form P-4B shall be used only for piping which contains no welded joints. See Section I PG-109

Note: Make certain that all items listed above are in compliance prior to requesting an inspection on a new or reinstalled boiler.